

## NEW APPLICATION TRANSMITTAL

ATTORNEY DOCKET NO. 1631

Assistant Commissioner for Patents  
Washington, DC 20231

Sir:

Enclosed herewith for filing is the patent application of:

Inventor(s): Paul S. White, Mary Elizabeth Larkin, Michael J. AgnesTitle: BATTERY PACK

Enclosed: 2 sheet(s) of drawings: ☐ Formal ☒ 2 copies - Informal  
7 pages of SPECIFICATION and ABSTRACT  
8 page(s) of CLAIMS  
☒ Declaration/Power of Attorney  
☒ Assignment

Certified Copy from which priority is claimed:

☐ Attached ☐ Will Follow ☒ Not Applicable

Country: \_\_\_\_\_ Appln. No. \_\_\_\_\_ Filed: \_\_\_\_\_

CLAIMS AS FILED				BASIC FEE
FOR	NUMBER FILED	NUMBER EXTRA	RATE	
				\$760.00
TOTAL CLAIMS ALLOWED - 20	- 65 -	- 45 -	X \$ 18.00	810.00
INDEPENDENT CLAIMS ALLOWED - 3	- 4 -	- 1 -	X \$ 78.00	78.00
MULTIPLE DEPENDENT CLAIMS			\$260.00	- 0 -
FEE FOR RECORDING ASSIGNMENT			\$40.00	\$40.00
<b>TOTAL FEES</b>				<b>\$1,688.00</b>

Please charge the TOTAL FEES and any additional fee due, and credit any overpayment, to Deposit Account No. 02-2548. [A duplicate copy hereof is enclosed.]

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**BATTERY PACK**Field of the Invention

This invention relates generally to battery packs and, more particularly, to battery  
5 packs for cordless power tools.

Background of the Invention

Cordless products which use rechargeable batteries are prevalent throughout the  
workplace as well as in the home. From housewares to power tools, rechargeable batteries  
10 are used in numerous devices. Ordinarily, nickel-cadmium or nickel-metal hydride  
battery cells are used in these devices. Since the devices use a plurality of battery cells,  
the battery cells are ordinarily packaged as battery packs. These battery packs couple  
with the cordless devices and secure to the device. The battery pack may be removed  
from the cordless device and charged in a battery charger or charged in the cordless  
15 device itself.

FIGS. 1-3 illustrate a typical battery pack 10, which includes a bottom housing  
11, a plurality of cells 12 disposed within the housing, a cell 13 disposed on the plurality  
of cells 12, and a terminal block 14 disposed on cell 13. Persons skilled in the art will  
recognize that the terminal block 14 and cells 12, 13 are electrically connected in a  
20 manner well known in the art, and that such electrical connections are not shown for the  
sake of clarity. Also, persons skilled in the art are referred to US Patent No. 5,144,217  
for further information on a typical prior art terminal block 14.

A pack cover 15 carrying a tower 16 is disposed on housing 11 so as to contain  
cells 12, 13 therein. Tower 16 has an aperture 17 exposing terminal block 14 for

electrical connection to the power tool (not shown). The pack cover 15 may be held in place via screws 19, or other means, so as adhesives, molten plastic, etc.

Typical battery packs include at least one latch mechanism 18 for latching the battery pack 10 to the power tool, or cordless device. Latch mechanism 18 typically includes a button 18B disposed on housing 11, a latch hook 18L movably connected to button 18B and movable between a latching position and an unlatched position, and a spring 18S for biasing latch hook 18L towards the latching position. Accordingly, in order to unlatch a battery pack from the power tool, the user needs to press button(s) 18B with one hand, moving latch hook 18L towards the unlatched position, and pull out the battery pack 10, while holding the power tool with the other hand..

Typically battery packs 10 have two buttons 18B on opposing walls of housing 11. Accordingly, the operator needs to bridge the composite distance of A, B and C, i.e., the lengths along the housing 11, in order to press both buttons 18B and unlatch battery pack 10. However, as the number of cells 12 is increased to obtain higher voltages, the composite distance (A+B+C) is also increased, until the operator cannot easily reach both buttons 18B.

### Summary of the Invention

In accordance with the present invention, an improved battery pack is employed.

20 The battery pack includes a housing with opposing walls, a plurality of cells disposed within the housing, at least two terminals electrically connected to the cells, a latching mechanism disposed on each opposing wall for latching the battery pack to a cordless device, each latching mechanism including a latch and a button disposed on the wall for

moving the latch between unlatching and latching positions, the latching buttons being disposed along a first plane, the first plane being substantially vertical, wherein the number of cells disposed along the first plane is smaller than the number of cells disposed along a second plane substantially parallel to the first plane. The battery pack may also

5 include a stacked cell disposed on the plurality of cells. The stacked cell may be disposed along the first plane. However, the stacked cell is not included in the number of cells disposed along the first plane.

Additional features and benefits of the present invention are described, and will be apparent from, the accompanying drawings and the detailed description below.

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#### Brief Description of the Drawings

The accompanying drawings illustrate preferred embodiments of the invention according to the practical application of the principles thereof, and in which:

FIG. 1 is an exploded perspective view of a prior art battery pack;

15

FIG. 2 is a rear view of the lower portion of the battery pack of FIG. 1;

FIG. 3 is a top plan view of the lower portion of FIG. 2 along line III-III;

FIG. 4 is a side view of a lower portion of the improved battery pack according to a first embodiment of the present invention;

FIG. 5 is a bottom plan view of the lower portion of FIG. 4 along line V-V;

20

FIG. 6 is a top plan view of the lower portion of FIG. 4 along line VI-VI;

FIG. 7 is a rear elevational view of the lower portion of FIG. 4 along line VII-VII;

and

FIG. 8 is a side view of a lower portion of the improved battery pack according to a second embodiment of the present invention.

### Detailed Description

5           The invention is now described with reference to the accompanying figures, wherein like numerals designate like parts. Referring to FIGS. 4-7, the battery pack 100 has a housing 11A, latch mechanisms 18 thereon, and cells 12 within housing 11A. Battery pack 100 may also have a pack cover 15, tower 16, terminal block 14 and/or cell 13 as taught in the prior art.

10           Preferably each of two opposing walls of housing 11A has a front portion 11F, a rear portion 11R and a channel portion 11C disposed between front and rear portions 11F, 11R. Preferably channel portion 11C is depressed relative to front and rear portions 11F, 11R. In other words, while front and rear portions 11F, 11R may be substantially coplanar, channel portion 11C is not.

15           Channel portion 11C may include a surface 11S. Preferably the distance between surface 11S and center plane Z is smaller than the distance between center plane Z and front and/or rear portions 11F, 11R. Surface 11S may be inclined or substantially parallel to front and/or rear portions 11F, 11R (though not coplanar).

20           Persons skilled in the art will recognize that button 18B may be disposed on surface 11S or within channel portion 11C. However, persons skilled in the art should recognize that buttons 18B may be disposed outside of channel portion 11C.

By providing such channel portions 11C, the effective distance between latch buttons 18B, i.e., the composite distance, is about  $D+E+F$ , and thus is smaller than

composite distance  $A+B+C$ , thus providing a more ergonomic access to the latching buttons 18B. Preferable, distance  $D+E+F$  is about or less than 4 inches, whereas the distance  $A+B+C$  is about 4.5 inches.

In order to obtain such arrangement, it is preferable to arrange cells 12 so that the number of cells 12 disposed between the latching buttons 18, or along plane X, is smaller than the number of cells 12 disposed elsewhere in housing Y, e.g., along plane Y. Such cell arrangement permits the surface 11S to be closer to the center plane Z.

A second embodiment is shown in FIG. 8, where like numerals refer to like parts. The teachings of the first embodiment are incorporated herein. Housing 11B, as before, may carry latching buttons 18B, and may have front and rear portions 11F, 11R. Housing 11B may also have a bottom surface 11BP, which is substantially planar along plane H. A channel portion 11D is preferably disposed between front and rear portions 11F, 11R, and/or below latching buttons 18B. Preferably, channel portion 11D has a surface 11DP which is disposed between buttons 18B and plane H. In other words, the distance between surface 11DP and buttons 18B is smaller than the distance between buttons 18B and plane H. Similarly, the distance between surface 11DP and top housing plane G is smaller than the distance between planes G and H, i.e., the height of housing 11.

In order to obtain such arrangement, it is preferable to arrange at least one of the cells 12 (cell 12H) so that it lays horizontally, as opposed to the other cells 12 which stand vertically, in housing 11. Such cell arrangement permits the surface 11DP to be closer to the buttons 18B, etc.

Housing 11 may also have vent holes 11H disposed thereon. In addition, housing 11 may have ribs 11R to help locate the cells 12 within housing 11. Preferably holes 11H are disposed between ribs 11R and/or the walls of housing 11.

Persons skilled in the art may recognize other alternatives to the means disclosed  
5 herein. However, all these additions and/or alterations are considered to be equivalents of the present invention.

CLAIMS

What is claimed is:

- 5           1. A battery pack comprising:
- a housing comprising opposing walls;
- a plurality of cells disposed within the housing;
- at least two terminals electrically connected to the cells;
- a latching mechanism disposed on each opposing wall for latching the battery
- 10   pack to a cordless device, each latching mechanism comprising a latch and a button
- disposed on the wall for moving the latch between unlatching and latching positions, the
- latching buttons being disposed along a first plane, the first plane being substantially
- vertical;
- wherein number of cells disposed along the first plane is smaller than number of
- 15   cells disposed along a second plane substantially parallel to the first plane.
2. The battery pack of Claim 1, further comprising a stacked cell disposed on the
- plurality of cells.
3. The battery pack of Claim 2, wherein the stacked cell is disposed along the
- first plane.
- 20           4. The battery pack of Claim 3, wherein the stacked cell is not included in the
- number of cells disposed along the first plane.
5. The battery pack of Claim 1, wherein at least one wall has first and second
- portions.
6. The battery pack of Claim 5, wherein at least one of the buttons is disposed on
- 25   the second portion of the at least one of the walls.



7. The battery pack of Claim 5, wherein the first and second portions comprise substantially non-coplanar surfaces.

8. The battery pack of Claim 7, wherein distance between the second portion surface and a center plane dissecting the housing is smaller than distance between the first portion surface and the center plane.

9. The battery pack of Claim 8, wherein the first portion surface is substantially vertical.

10. The battery pack of Claim 8, wherein the second portion surface is substantially vertical.

11. The battery pack of Claim 8, wherein the second portion surface is inclined.

12. The battery pack of Claim 8, wherein at least one of the buttons is disposed on the second portion surface of the at least one of the walls.

13. The battery pack of Claim 1, wherein the cells are vertical.

14. The battery pack of Claim 1, wherein at least one of the cells is vertical.

15. The battery pack of Claim 1, wherein the housing comprises a floor.

16. The battery pack of Claim 15, wherein the floor is substantially horizontal.

17. The battery pack of Claim 15, wherein the latching buttons are disposed along a first line located at a first distance from the floor.

18. The battery pack of Claim 17, wherein distance between the latching buttons along periphery of the housing is smaller than distance between two points along periphery of the housing, the two points being contained within a second line parallel to the first line and located at the first distance from the floor.

19. A battery pack comprising:

a housing comprising opposing walls, at least one of the walls having first and second portions, the first and second portions comprising substantially non-coplanar surfaces, the housing being dissected by a center plane;

5 a plurality of cells disposed within the housing;

at least two terminals electrically connected to the cells;

a latching mechanism disposed on the housing for latching the battery pack to a cordless device, the latching mechanism comprising a latch and a button disposed on the second portion for moving the latch between unlatching and latching positions;

10 wherein distance between the second portion surface and the center plane is smaller than distance between the first portion surface and the center plane.

20. The battery pack of Claim 19, wherein the first portion surface is substantially vertical.

21. The battery pack of Claim 19, wherein the second portion surface is  
15 substantially vertical.

22. The battery pack of Claim 19, wherein the second portion surface is inclined.

23. The battery pack of Claim 19, wherein at least one of the buttons is disposed on the second portion surface of the at least one of the walls.

24. The battery pack of Claim 19, wherein the cells are vertical.

20 25. The battery pack of Claim 19, wherein at least one of the cells is vertical.

26. The battery pack of Claim 19, wherein the housing comprises a floor.

27. The battery pack of Claim 26, wherein the floor is substantially horizontal.

28. The battery pack of Claim 26, further comprising a latching button on the other wall.

29. The battery pack of Claim 28, wherein the latching buttons are disposed along a first line located at a first distance from the floor.

5           30. The battery pack of Claim 29, wherein distance between the latching buttons along periphery of the housing is smaller than distance between two points along periphery of the housing, the two points being contained within a second line parallel to the first line and located at the first distance from the floor.

10           31. The battery pack of Claim 28, wherein number of cells disposed along a first plane between the latching buttons is smaller than number of cells disposed along a second plane substantially parallel to the first plane.

32. The battery pack of Claim 31, further comprising a stacked cell disposed on the plurality of cells.

15           33. The battery pack of Claim 32, wherein the stacked cell is disposed along the first plane.

34. The battery pack of Claim 33, wherein the stacked cell is not included in the number of cells disposed along the first plane.

35. A battery pack comprising:

20           a housing comprising a floor and opposing walls connected to the floor, at least one wall having first and second portions;

a plurality of cells disposed within the housing;

at least two terminals electrically connected to the cells;

a latching mechanism disposed on each opposing wall for latching the battery pack to a cordless device, each latching mechanism comprising a latch and a button disposed on each wall for moving the latch between unlatching and latching positions, the latching buttons being disposed along a first line located at a first distance from the floor;

- 5            wherein distance between the latching buttons along periphery of the housing is smaller than distance between two points along periphery of the housing, the two points being contained within a second line parallel to the first line and located at the first distance from the floor and in the first portion.

- 10           36. The battery pack of Claim 35, wherein the first and second portions comprise substantially non-coplanar surfaces.

37. The battery pack of Claim 36, wherein distance between the second portion surface and a center plane dissecting the housing is smaller than distance between the first portion surface and the center plane.

- 15           38. The battery pack of Claim 36, wherein the first portion surface is substantially vertical.

39. The battery pack of Claim 36, wherein the second portion surface is substantially vertical.

40. The battery pack of Claim 36, wherein the second portion surface is inclined.

- 20           41. The battery pack of Claim 36, wherein at least one of the buttons is disposed on the second portion surface of the at least one of the walls.

42. The battery pack of Claim 35, wherein the cells are vertical.

43. The battery pack of Claim 35, wherein at least one of the cells is vertical.

44. The battery pack of Claim 35, wherein number of cells disposed along a first plane between the latching buttons is smaller than number of cells disposed along a second plane substantially parallel to the first plane.

45. The battery pack of Claim 44, further comprising a stacked cell disposed on  
5 the plurality of cells.

46. The battery pack of Claim 45, wherein the stacked cell is disposed along the first plane.

47. The battery pack of Claim 46, wherein the stacked cell is not included in the number of cells disposed along the first plane.

10 48. A battery pack comprising:

a housing comprising a first portion having a first floor and first and second walls connected to the first floor, and a second portion having a second floor and third and fourth walls connected to the second floor, where the first and second floors are non-coplanar;

15 a plurality of cells disposed within the housing; and  
at least two terminals electrically connected to the cells.

49. The battery pack of Claim 48, further comprising first and second latching mechanisms disposed on the housing for latching the battery pack to a cordless device.

50. The battery pack of Claim 49, wherein each latching mechanism comprises a  
20 latch and a button connected to the latch for moving the latch between unlatching and latching positions.

51. The battery pack of Claim 50, wherein at least one button is disposed on the second portion.

52. The battery pack of Claim 50, wherein the latching buttons are disposed along a first line located at a first distance from first floor plane.

53. The battery pack of Claim 52, wherein distance between the latching buttons along periphery of the housing is smaller than distance between two points along periphery of the housing, the two points being contained within a second line parallel to the first line and located at the first distance from the first floor plane.

54. The battery pack of Claim 50, wherein number of cells disposed along a first plane between the latching buttons is smaller than number of cells disposed along a second plane substantially parallel to the first plane.

55. The battery pack of Claim 54, further comprising a stacked cell disposed on the plurality of cells.

56. The battery pack of Claim 55, wherein the stacked cell is disposed along the first plane.

57. The battery pack of Claim 56, wherein the stacked cell is not included in the number of cells disposed along the first plane.

58. The battery pack of Claim 48, wherein the first and second portions comprise substantially non-coplanar surfaces.

59. The battery pack of Claim 58, wherein distance between the second portion surface and a center plane dissecting the housing is smaller than distance between the first portion surface and the center plane.

60. The battery pack of Claim 58, wherein the first portion surface is substantially vertical.

61. The battery pack of Claim 58, wherein the second portion surface is substantially vertical.

62. The battery pack of Claim 58, wherein the second portion surface is inclined.

63. The battery pack of Claim 58, wherein at least one of the buttons is disposed

5 on the second portion surface.

64. The battery pack of Claim 48, wherein at least one of the cells is horizontal.

65. The battery pack of Claim 64, wherein at least one of the cells is vertical.

ABSTRACT

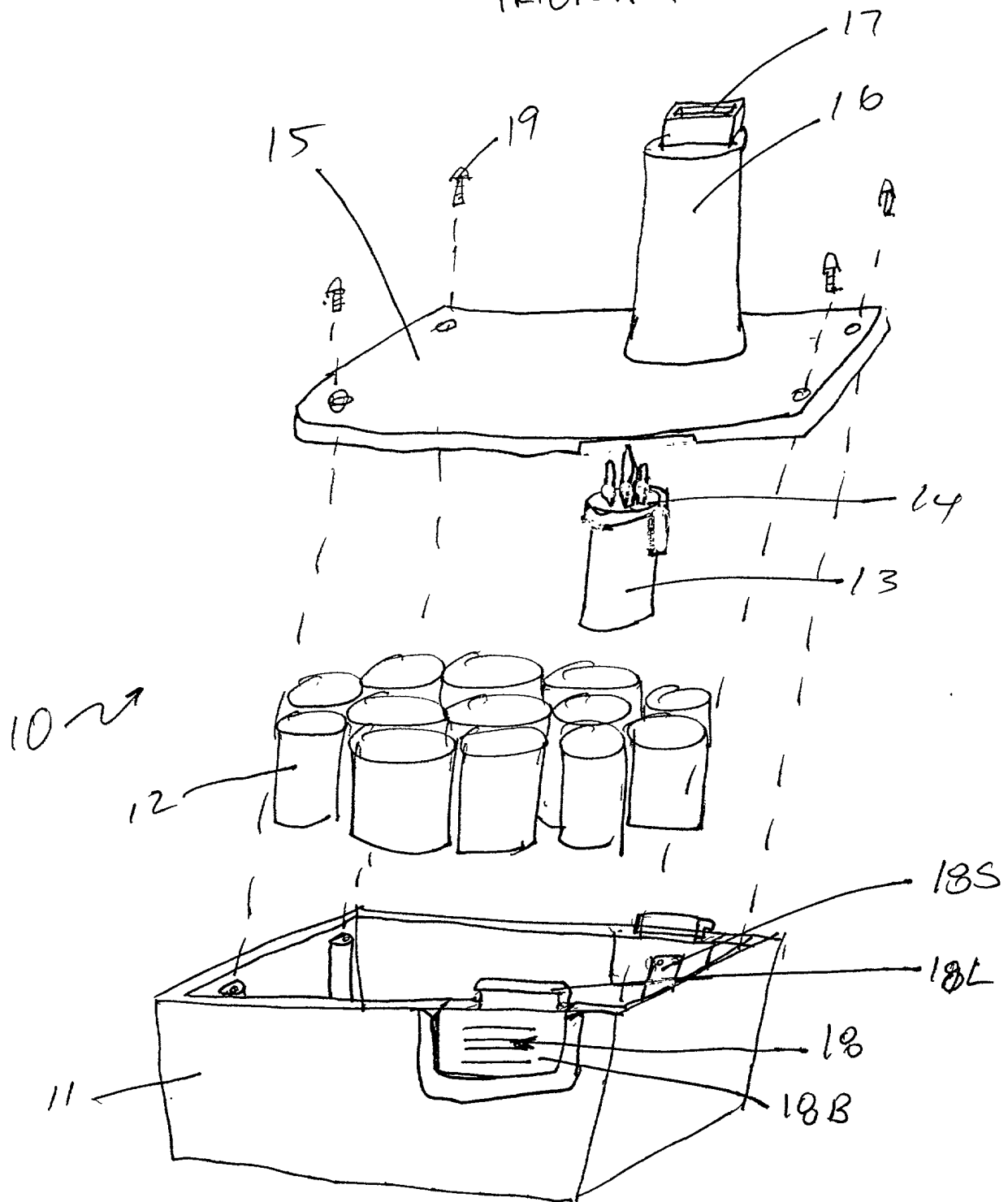
In accordance with the present invention, an improved battery pack is employed.

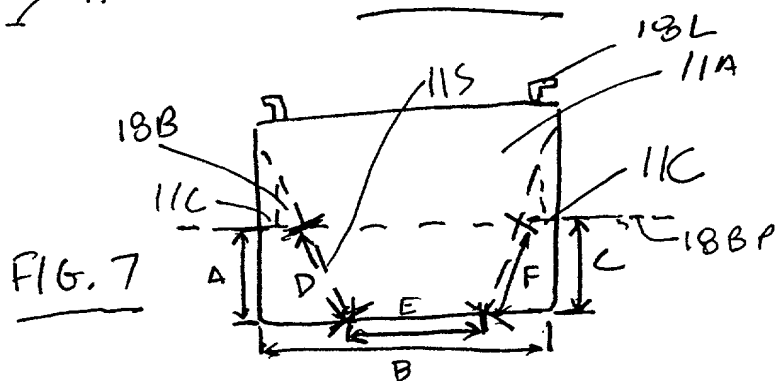
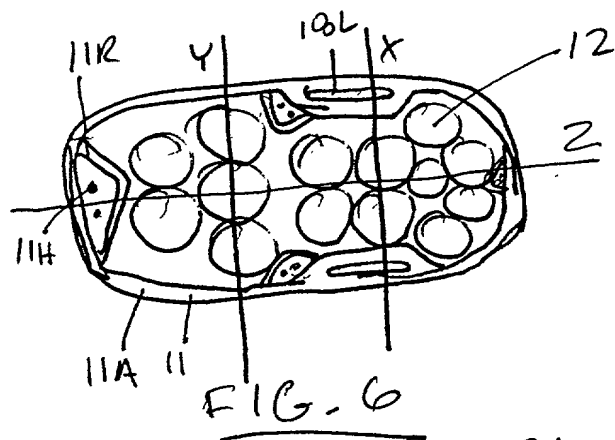
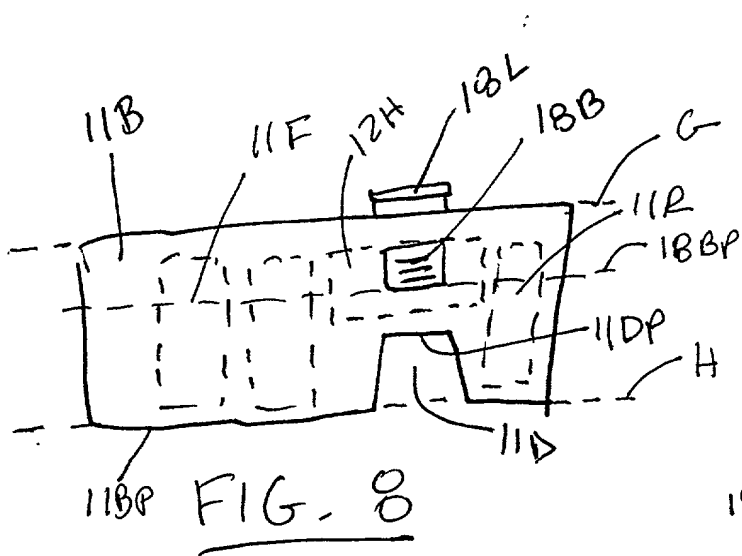
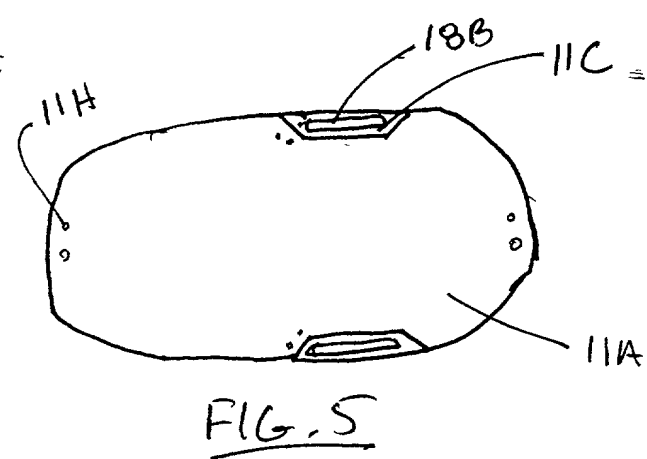
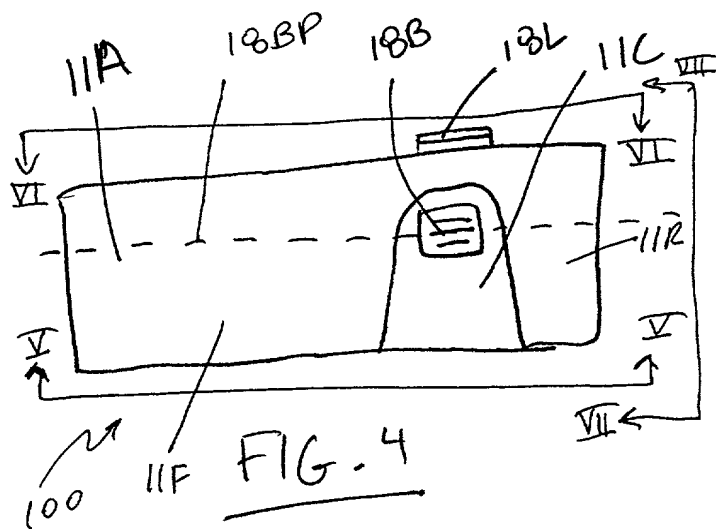
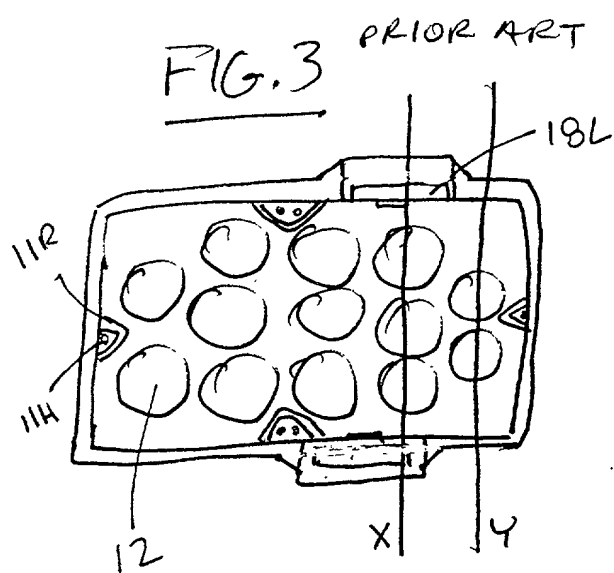
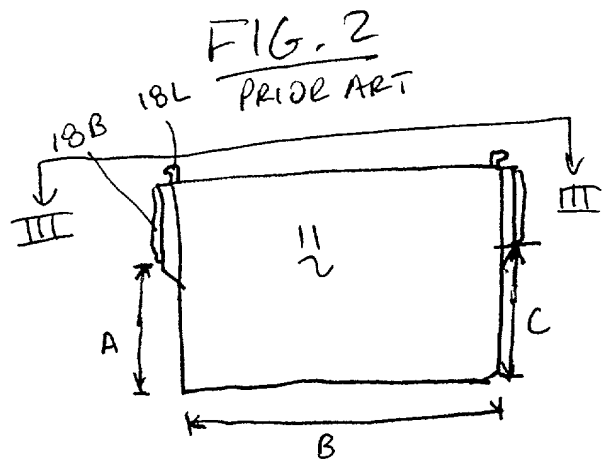
The battery pack includes a housing with opposing walls, a plurality of cells disposed within the housing, at least two terminals electrically connected to the cells, a latching

- 5 mechanism disposed on each opposing wall for latching the battery pack to a cordless device, each latching mechanism including a latch and a button disposed on the wall for moving the latch between unlatching and latching positions, the latching buttons being disposed along a first plane, the first plane being substantially vertical, wherein the number of cells disposed along the first plane is smaller than the number of cells disposed
- 10 along a second plane substantially parallel to the first plane. The battery pack may also include a stacked cell disposed on the plurality of cells. The stacked cell may be disposed along the first plane. However, the stacked cell is not included in the number of cells disposed along the first plane.



FIG. 1  
PRIOR ART





## COMBINED DECLARATION AND POWER OF ATTORNEY

## FOR PATENT APPLICATION

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated next to my name; that I believe that I am the original, first and sole inventor (if only one inventor is named below) or an original first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled BATTERY PACK the specification of which:

☒ is attached hereto

☐ was filed on \_\_\_\_\_, assigned Serial No. \_\_\_\_\_ and was amended on \_\_\_\_\_

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
_____ (Number)	_____ (Country)	_____ (Month/Day/Year Filed)	_____ Yes	_____ No
_____ (Number)	_____ (Country)	_____ (Month/Day/Year Filed)	_____ Yes	_____ No

I hereby claim the benefit under Title 35, United States Code, §119(e) and/or §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

_____ (Application No.)	_____ (Filing Date)	_____ (Status-Patent, Pending, Abandoned)
_____ (Application No.)	_____ (Filing Date)	_____ (Status-Patent, Pending, Abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity or the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorneys to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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